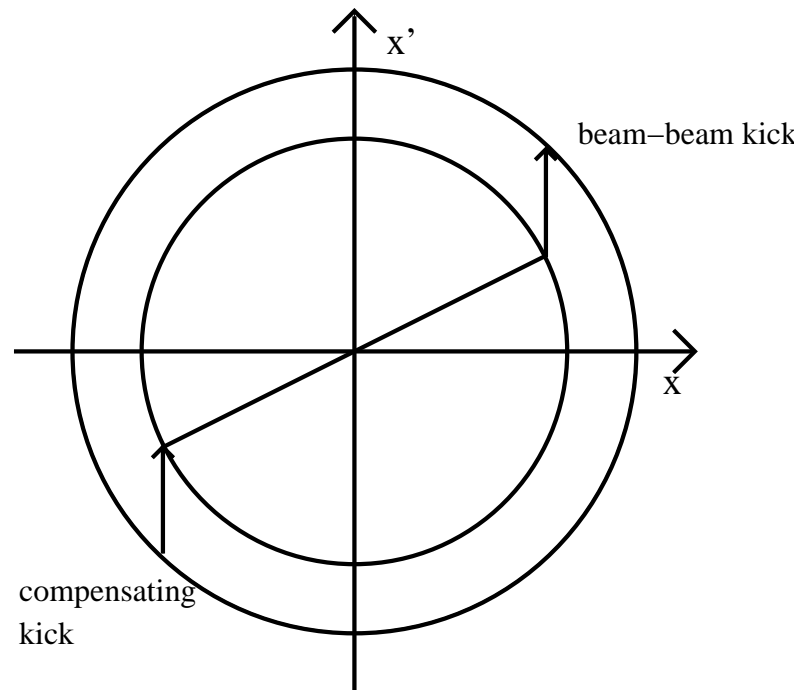


E-lens lattice studies

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Basics



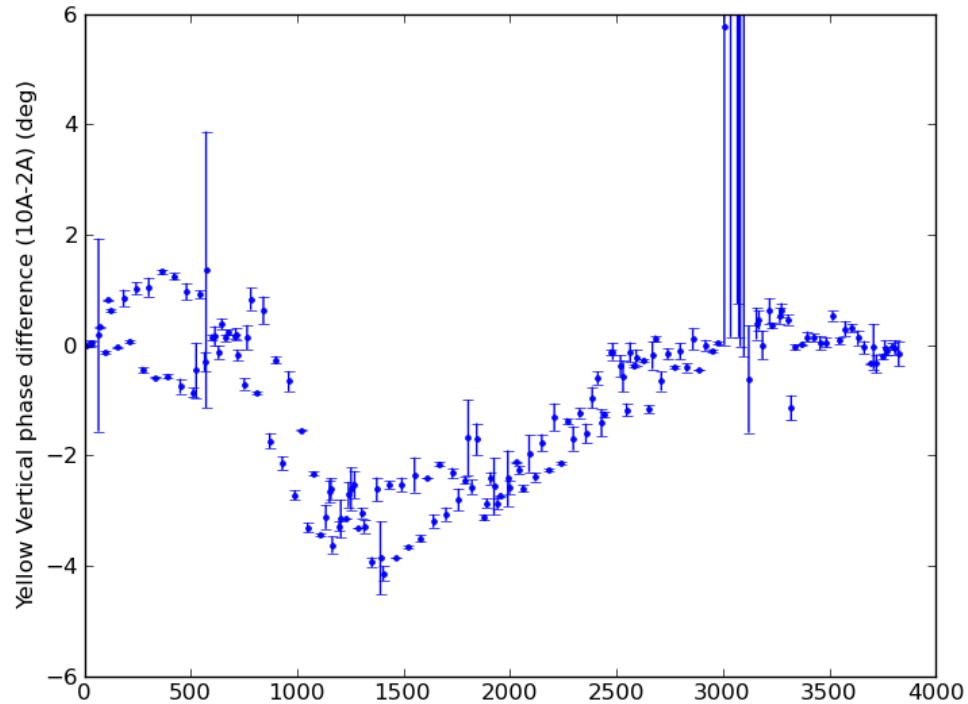
Beam-beam compensation requires $k \cdot 180^\circ$ phase advance between IP 8 and e-lens

- Phase advance is set to $k \cdot 180^\circ$ by additional shunt supplies on the QD and QF buss between IPs 8 and 10 (“phase shifter”)
- Shunt supply current is limited by leads, shared with Q7 and Q89, resp.
- To minimize phase shifter currents, (integer) working point needs to be changed to (27.68/29.69) in Blue, (29.69/30.68) in Yellow

Phase shifter studies

- According to simulation studies, phase advance between IP 8 and e-lens has to be correct within a few degrees
- To be able to set the correct phase advance, we need to measure it with an accuracy of approx. one degree
- During APEX, modified phase advance with the phase shifter, and measured it with the AC dipole

Measured phase advance for 10 A phase shifter current



Good agreement between expectation (2.9 degrees) and measurement (3 ± 1 degrees)

Longitudinal injection matching

- Horizontal tunes in the two rings are different by 2 integers
- In pure FODO lattice, $\gamma_t \approx Q_x$ - expected γ_t to differ by two units as well
- Nice surprise: $\gamma_t = 23.01$ in Blue, 23.77 in Yellow (Run-12 unmodified lattice had 23.2 in both)

APEX studies in Run-12:

- Injection γ_t can be shifted by as much as 0.8 units, using γ_t -quads
- Using the 9 MHz RF system, longitudinal matching between AGS and RHIC can be achieved by lowering RF voltage at $\gamma_t = 23.2$
- Strategy for e-lens lattice:
 - Set γ_t to 23.2 (or lower) in both rings, using γ_t -quads
 - Lower 9 MHz RF voltage accordingly until longitudinal matching is achieved
 - If needed, RF voltage can be set to different values, depending which ring is being injected

Summary

- Phase shifter has been demonstrated to work as expected
- Phase advance between IP 8 and e-lens can be measured with required accuracy
- Longitudinal injection matching with higher γ_t seems feasible